Claims

1. Apparatus for measuring a plurality of optically detectable beads, such as polymer beads, said apparatus comprising

   a) a vacuum container comprising at least one planar capture body capable of rotating around a central axis,

      wherein said capture body comprises a plurality of through-going inlets,

      wherein the diameter of each inlet is smaller than the average diameter of the beads to be measured and/or analysed and/or sorted,

   b) a pressure controlling device capable of controlling the pressure in the vacuum container, and

   c) a device for rotating the vacuum container around the axis of the capture disc.

   d) a device for measuring at least one property of at least one bead

2. The apparatus according to claim 1 wherein the ratio R between a) the average diameter of the beads being manipulated, and b) the diameter of the through-going inlets, R=a/b, is more than 2, such as more than 4, for example more than 6, such as more than 8, for example more than 10, such as more than 12, for example more than 14, such as more than 16, for example more than 18, such as more than 20, for example more than 25, such as more than 30, for example more than 35, such as more than 40, for example more than 50, and preferably less than 100.

3. The apparatus according to any of claims 1 and 2, wherein the capture body is a planar disc.

4. The apparatus according to any of claims 1 to 3 wherein the distance between the axis of rotation of the capture body and each of the through-going inlets of

the capture body is the same for each of the through-going inlets of the capture body.

5. The apparatus according to claim 4 wherein the distance between neighbouring through-going inlets is the same for all pairs of neighbouring through-going inlets.

6. The apparatus according to any of claims 1 to 5 further comprising a circular capture disc support supporting the capture disc at a distal end and being connected at a proximal end to a hollow shaft, wherein the hollow shaft is fitted with a shaft opening so that a vacuum can be applied to the interior of the vacuum container,

7. The apparatus according to claim 6 further comprising a vacuum container housing comprising an outer cylinder comprising an opening for connecting the shaft hole with the pressure controlling device, and a guiding plate comprising at least one opening allowing the through-going inlets to be accessible to beads to be loaded onto the capture disc, said guiding plate being attached to the top part of the outer cylinder, thereby defining in the space between the guiding plate and the capture disc a guiding channel for harbouring beads, said guiding plate confining the vacuum container to the interior of the vacuum container housing.

8. The apparatus according to any of claims 1 to 7, wherein the vacuum container is connected to a device for rotating the vacuum container, such as a stepper motor, operably linked to a momentum transfer split for transferring the momentum from the stepper motor to the vacuum container thereby causing the vacuum container to rotate in a controlled step-wise fashion.

9. The apparatus according to any of claims 1 to 8 wherein the pressure controlling device comprises a pump.

10. The apparatus according to any of claims 1 to 9, wherein the measuring device comprises at least one source of illumination and at least one image capturing device.

11. The apparatus according to claim 10 wherein the source of illumination comprises at least one laser

12. The apparatus according to claim 11 wherein the at least one laser is a focussed scanning laser.

13. The apparatus according to any of claims 10 to 12, wherein the at least one image capturing device comprises at least one CCD camera.

14. The apparatus according to any of claims 10 to 13 further comprising at least one pulse generator, at least one image intensifier, and at least one fluorescence filter.

15. The apparatus according to any of claims 13 and 14 comprising one pulse generator, two image intensifiers, two fluorescence filters, and two CCD-cameras.

16. The apparatus according to any of claims 1 to 9, wherein the measuring device comprises at least one spectrophotometer.

17. The apparatus according to any of claims 1 to 9, wherein the measuring device comprises at least one source of illumination and at least one photo-sensor.

18. The apparatus according to claim 17, wherein the at least one source of illumination comprises at least one laser.

19. The apparatus according to any of claims 17 and 18, wherein the at least one photo-sensor comprises a photo-multiplier tube.

20. The apparatus according to any of claims 17 to 19 further comprising at least one optical fibre and at least one fluorescence filter

21. The apparatus according to any of claims 19 and 20 comprising one laser, one optical fibre, one fluorescence filter, and one photo-multiplier tube.

22. The apparatus according to any of claims 1 to 21 further comprising an analysing device for analysing results being generated from the measurement of the at least one property of the at least one bead, wherein said analysis enables individual beads to be characterised and/or identified and optionally also sorted.

23. The apparatus according to claim 22, wherein the analysing device comprises a computer capable of executing a data analysis program.

24. The apparatus according to any of claims 22 to 23 further comprising a data storage medium for storing data generated by the measuring device and/or analysing device.

25. The apparatus according to any of claims 22 to 24 further comprising at least one device for sorting a plurality of beads on the basis of the result generated by the analysing device.

26. The apparatus according to claim 25, wherein the sorting device comprises a plurality of sorting channels for separating the plurality of beads into fractions thereof and at least one bead displacement device for displacing at least one bead of the plurality of beads from the capture body in accordance to the result generated by the analysing device.

27. The apparatus according to claim 26, wherein the at least one bead displacing device comprises a cylinder for physically removing at least one bead from its capture hole by suction and a valve for connecting and disconnecting a vacuum to the inside of the cylinder.

28. The apparatus according to claim 26, wherein the at least one bead displacing device comprises a bead displacing body for physically removing at least one bead from its capture hole, and a device for spatially manipulating the bead displacing body.

29. The apparatus according to claim 28, wherein the bead displacing body comprises a magnetic material, and wherein the device for spatially manipulating the bead displacement body comprises an electromagnet.

30. The apparatus according to claim 26, wherein the at least one bead displacing device comprises a cylinder for blowing away at least one bead from its capture hole, a high pressure fluid source for generating the flow for blowing away the at least one bead from its capture hole, and a valve for connecting said cylinder to said high pressure fluid source.

31. The apparatus according to any of claims 1 to 30 further comprising a treating device for treating at least one bead optionally having been subjected to measuring or analysing.

32. The apparatus according to claim 31, wherein the treating device comprises a laser for etching at least one bead or part thereof.

33. The apparatus according to claim 31, wherein the treating device comprises a laser for bleaching at least one bead or part thereof.

34. The apparatus according to claims 31 to 33, wherein the treating device comprises a plurality of compartments comprising chemical building blocks said compartments being connected to the treating section by at least one tube for diverting individual chemical building blocks to the treating section.

35. The apparatus according to any of the previous claims further comprising a bead loading device for loading beads onto the capture disc.

36. The apparatus according to claim 35, where the bead loading device comprises a syringe pump comprising a dispersion of beads to be loaded onto the capture disc.

37. The apparatus according to any of the previous claims further comprising a bead unloading device for unloading beads from the capture disc.

38. The apparatus according to claim 37, wherein the bead unloading device comprises a blocking device positioned in the track defined by the rotating throughgoing inlets of the capture body and at a distance less than half the average

bead diameter from the surface of the capture disk for physically removing the beads from the through-going inlets.

39. The apparatus according to claim 37, wherein the bead unloading device comprises a suction device for physically removing the beads from the through-going inlets and subsequently from the capture body.

40. The apparatus according to claim 37, wherein the bead unloading device comprises a blocking device for physically removing the beads from the through-going inlets and a suction device for removing the beads from the capture body.

41. The apparatus according to any of claims 39 and 40, where the suction device comprises a pump and a filter for retaining beads removed from the capture body.

42. The apparatus according to any of the previous claims further comprising an excess bead flushing device for flushing away non-captured beads from captured beads.

43. The apparatus according to claim 42, where the excess bead flushing device comprises a pump and a dispersion liquid outlet positioned adjacent to the track defined by the rotating through-going inlets in the capture disc at a distance greater than the average bead diameter from the surface of the capture disc.

44. The apparatus according to any of claims 7 to 43 wherein the guiding plate comprises a plurality of openings each such opening defining a section selected from the group consisting of loading section for loading beads onto the capture disc and unloading section for removing beads from the capture disc.

45. The apparatus according to claim 44 further comprising guiding plate openings selected from the group consisting of excess bead unloading section for unloading excess beads, flushing section for flushing away non-captured beads from captured beads, and sorting section for separating at least one bead from the plurality of beads.

46. The apparatus according to claims 44 and 45, wherein the orientation of sections with respect to each other, in the direction of the rotation of the capture disc, is defined by the following order: excess bead unloading section, when present, bead loading section, excess bead flushing section, when present, sorting section, when present, and bead unloading section.

47. The apparatus according to any of claims 44 to 46 wherein the guiding plate further comprises at least one measuring section for measuring at least one property of at least one bead.

48. The apparatus according to claim 47, wherein the at least one measuring section of the guiding plate comprises at least one transparent window for allowing the measuring device to record at least one property of at least one bead.

49. A method for measuring at least one property of at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for measuring at least one property of at least one bead according to any of claims 1 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container, and

v) using the measuring device of the apparatus for measuring at least one property of at least one bead.

50. A method for analysing data generated by measuring at least one property of at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for analysing at least one property of at least one bead according to any of claims 22 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead, and

vi) analysing data generated by the measuring device for measuring at least one property of at least one bead.

51. A method for identifying at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for analysing at least one property of at least one bead according to any of claims 22 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead, and

vi) using the analysing device for analysing data generated by the measuring device for measuring at least one property of at least one bead, and

vii) identifying at least one bead of a plurality of beads by analysing the data generated by the measuring device for measuring at least one property of at least one bead.

52. A method for sorting at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for sorting at least one bead according to any of claims 25 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead,

vi) using the analysing device for analysing data generated by the measuring device for measuring at least one property of at least one bead, and

vii) sorting the at least one bead of a plurality of beads based on the result of the analysis performed in step vi).

53. A method for sorting at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for sorting at least one bead according to any of claims 25 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead, and

vi) using the analysing device for analysing data generated by the measuring device for measuring at least one property of at least one bead,

vii) identifying at least one bead of a plurality of beads by analysing the data generated by the measuring device for measuring at least one property of at least one bead, and

viii) sorting the at least one bead of a plurality of beads based on the identification performed in step vii).

54. A method for treating at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for treating at least one bead according to any of claims 31 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead,

vi) analysing data generated by the measuring device for measuring at least one property of at least one bead, and

vii) treating at least one bead of a plurality of beads based on the result of the analysis performed in step vi).

55. A method for treating at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label

ii) providing an apparatus for treating at least one bead according to any of claims 31 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead, and

vi) using the analysing device for analysing data generated by the measuring device for measuring at least one property of at least one bead,

vii) identifying at least one bead of a plurality of beads by analysing the data generated by the measuring device for measuring at least one property of at least one bead, and

viii) treating at least one bead of a plurality of beads based on the identification obtained in step vii).

56. A method for treating at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for treating at least one bead according to any of claims 31 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead,

vi) analysing data generated by the measuring device for measuring at least one property of at least one bead,

vii) sorting the at least one bead of a plurality of beads based on the result of the analysis performed in step vi), and

viii) treating the at least one bead of a plurality of beads having been sorted in step vii).

57. A method for treating at least one bead of a plurality of beads, such as polymer beads, said method comprising the steps of

i) providing a plurality of beads each comprising at least one label,

ii) providing an apparatus for treating at least one bead according to any of claims 31 to 48,

iii) contacting at least one bead of the plurality of beads provided in step i) with the vacuum container capture body of the apparatus provided in step ii),

iv) rotating the capture body to transfer at least one bead from the loading section of the vacuum container to the measuring section of the vacuum container,

v) using the measuring device of the apparatus for measuring at least one property of at least one bead, and

vi) using the analysing device for analysing data generated by the measuring device for measuring at least one property of at least one bead,

vii) identifying at least one bead of a plurality of beads by analysing the data generated by the measuring device for measuring at least one property of at least one bead,

viii) sorting the at least one bead of a plurality of beads based on the identification performed in step vii), and

ix) treating the at least one bead of a plurality of beads having been sorted in step viii).

58. The method of any of claims 49 to 57, wherein the measuring of at least one property of at least one optically detectable bead located in the measuring section of the apparatus comprises the steps of

i) activating a source of illumination,

ii) capturing at least one image of the at least one optically detectable bead, and

iii) optionally storing the at least one image of the at least one optically detectable bead.

59. The method of any of claims 50 to 57, wherein the optically detectable beads to be analysed comprises a plurality of immobilised microparticles each comprising at least one label.

60. The method of claim 59, wherein the analysis of data generated by measuring at least one property of at least one optically detectable bead comprises determining spatial positions of a plurality of immobilised microparticles in each bead, wherein said microparticles are defined by at least one set of coordinates (x_n,y_n,z_n), where n = 1,2, ..., N; N being the total number of microparticles of the at least one bead.

61. The method of claim 60, wherein the determination of the spatial positions (x_n,y_n,z_n) of each immobilised microparticle of the at least one bead comprises the steps of

i) recording at least two 2D-projections of the microparticles of each bead, and

ii) determining, on the basis of the relative positions in space of centers (x,y,z) of the immobilised microparticles, either a) the distance matrix for individual microparticles, or b) a set of geometrical figures, such as triangles, derivable from the relative positions in space of centers (x,y,z) of the immobilised microparticles.

62. The method of any of claims 60 and 61, wherein 3 2D-projections are recorded along 3 orthogonal axis x, y and z to generate 3 sets of 2D-coordinates (y,z), (x,z) and (x,y), respectively, from which the 3D-coordinates (x,y,z) of a microparticle center can be derived.

63. The method of claim 62, wherein a plurality or stack of 2D projections are generated by confocal or focal microscopy to recreate the 3D image matrix of the bead from which the relative microparticle position (x,y,z) in space can be determined.

64. The method of any of claims 60 to 63, wherein the step of analysing data generated by the measuring device comprises using at least one focussed scanning laser for detection of relative positions in space of centers (x,y,z) of immobilised microparticles.

65. The method of claim 64, wherein coordinates x and y of a microparticle position are determined by fast scanning two orthogonally aligned lasers over three cross sections of a bead attached to the capture body.

66. The method of any of claims 60 to 63, wherein coordinates x and y of a microparticle position in a bead are determined by using a single laser and a rotat-

ing mirror which reflects, via 2 or 3 geometrically arranged static mirrors, the laser beam along 2 or 3 orthogonal axes.

67. The method of claim 60, wherein the analysis comprises a determination of the at least one distance matrix of at least one bead comprising a plurality of spatially immobilised microparticles comprising an optically detectable label, wherein the distance matrix is determined by

i) activating at least one source of illumination of the measuring device,

ii) recording at least one image of the at least one bead by sending substantially simultaneously a pulse generated by a pulse generator to both a) at least one image intensifier of the analysing device, and b) at least one CCD camera of the analysing device capable of recording said at least one image, and

iii) determining for individual beads a distance matrix based on the at least one image obtained for each bead in step ii

68. The method of any of claims 61 to 67, wherein a set of multiple distance matrices is determined for a subpopulation of the beads based on more than one set of individual distances recorded for the subpopulation of beads.

69. The method of any of claims 61 and 68, wherein each distance matrix is recorded individually.

70. The method of any of claims 61 to 69, wherein at least one image of each bead is recorded per second.

71. The method of any of claims 61 to 70, wherein a total of more than 4000 beads are measured per hour, such as more than 5000 beads per hour, for example more than 10000 beads per hour, such as more than 15000 beads per hour, for example more than 20000 beads per hour such as more than 25000 beads per hour, for example more than 30000 beads per hour such as more than 40000

beads per hour, for example more than 50000 beads per hour such as more than 60000 beads per hour, for example more than 70000 beads per hour, such as more than 80000 beads per hour, for example more than 90000 beads per hour such as more than 100000 beads are recorded per hour.

72. The method of any of claims 51, 53, 55, and 56, wherein the optically detectable beads to be identified comprises a plurality of immobilised microparticles each comprising at least one label.

73. The method of claim 71, wherein the step of identifying at least one bead of a plurality of beads comprises the steps of

i) determining at least one set of spatial positions of three or more microparticles in the at least one bead to be identified,

ii) deriving from the at least one set of spatial positions, a set of corresponding matrices of the distances between the three or more microparticles,

iii) deriving from the corresponding set of matrices all possible triangles defined by the three or more microparticles,

iv) identifying said at least one identifiable spatially encoded bead based on comparison of all possible triangles for said bead with all sets of possible triangles for the plurality of beads.

74. The method of any of claims 60 to 73 comprising the further step of performing a digital 3D registration of at least some of the identified beads, said 3D registration comprising generating a digital 3D reconstruction of the at least some identified beads based on the orthogonal pairs of images, and wherein the identification of individual beads is aided by an analysis of which of the generated 3D reconstructions represents the best fit to the original 3D registration.

75. The method of any of claims 54 to 57, wherein the step of treating at least one bead of a plurality of beads comprises one or more of the treating steps selected

from the group consisting of etching the at least one bead, bleaching the at least one bead, heating the at least one bead, and exposing the at least one bead to at least one chemical building block under reaction conditions suitable for the reaction of said building block.

76. A method for recording individual reaction steps involved in the step-wise synthesis of a chemical compound on an optically detectable bead, said method comprising the steps of

a) spatially immobilizing a plurality of microparticles in each optically detectable bead,
b) isolating, preferably by automated selection, at least a subset of the spatially encoded beads provided in step a),
c) recording and storing a distance matrix or a geometrical figure derivable from the distance matrix for each bead, wherein said distance matrix or geometrical figure is preferably generated by any of the methods disclosed herein,
d) stepwise synthesising chemical compounds on functional groups present on the encoded beads, wherein the identity of each bead is recorded and stored for each reaction step, and
e) obtaining for each bead a record of the individual reaction steps.

77. A method for identifying a chemical compound having been synthesised on an optically detectable bead comprising a plurality of spatially immobilised microparticles comprising at least one label, said method comprising the steps of

a) performing the recording method of claim 76,
b) selecting beads of interest by using an assay or a diagnostic screen selective for the chemical compound having been synthesized on the bead,
c) recording the distance matrix for each of the beads selected in step b),
d) comparing the distance matrix recorded in step c) with all of the distance matrices recorded and stored in step c) of claim 75,

thereby obtaining information about the identity of the selected bead,

e) identifying for each selected bead the sequence of individual steps having lead to the synthesis of the chemical compound, and

f) identifying, based the sequence of individual steps, the chemical structure of the compound.

78. The method of claim 77, wherein the assay is a binding assay performed by measuring the binding of a protein to a ligand bound to the polymer matrix.

79. The method of claim 77, wherein the assay is performed by measuring an enzyme activity on a substrate bound to the polymer matrix.

80. The method of claim 77, wherein the assay is performed by measuring enzyme inhibition of a molecule bound to the polymer matrix.

81. The method of claim 77, wherein the assay is performed by measuring receptor interaction with a compound bound to the polymer matrix.

82. The method of any of claims 77 to 81, wherein said plurality of beads comprise a fluorescence detectable marker.

83. The method of claim 82, wherein said fluorescence detectable marker is detectable by two photon fluorescence microscopy.

84. The method of claim 82, wherein said fluorescence detectable marker is detectable by one photon fluorescence microscopy.

85. The method of claim 82, wherein said fluorescence detectable marker is a UV or visible light-excitable microparticles.

86. The method of any of claims 49 to 75, wherein the at least one bead comprises a plurality of spatially immobilised microparticles each comprising at least one label, wherein each microparticle is individually detectable.

87. The method of any of claims 49 to 75, wherein the at least one bead has different optical or spectroscopic properties from those of the immobilised microparticles each comprising at least one label.

88. The method of claim 86, wherein the size distribution of immobilised microparticles is mono-disperse.

89. The method of claim 86, wherein the size distribution of immobilised microparticles is hetero-disperse.

90. The method of claim 86, wherein the immobilised microparticles are spherical.

91. The method of claim 86, wherein the immobilised microparticles are irregular microparticles.

92. The method of claim 86, wherein the at least one bead comprises at least 2 microparticles.

93. The method of claim 86, wherein the at least one bead comprises 3 or more microparticles.

94. The method of claim 86, wherein the at least one bead comprises 4 or more microparticles.

95. The method of any of claims 86 to 94, wherein the at least one bead comprises 10 or less microparticles.

96. The method of any of claims 86 to 94, wherein the at least one bead comprises less than 5 microparticles.

97. The method of any of claims 86 to 96, wherein the at least one bead is essentially spherical.

98. The method of any of claims 86 to 97, wherein the at least one bead comprises at least two of said microparticles, and wherein said at least two microparticles have essentially the same diameter.

99. The method of any of claims 86 to 98, wherein all of said microparticles are essentially mono-disperse.

100. The method of any of claims 86 to 99, wherein all of said microparticles are less than 10 micrometer in diameter.

101. The method of any of claims 86 to 100, wherein all of said microparticles are less than 5 micrometer in diameter.

102. The method of any of claims 86 to 101, wherein all of said microparticles are less than 1 micrometer in diameter.

103. The method of any of claims 86 to 102, wherein all of said microparticles are less than 0.1 micrometer in diameter.

104. The method of any of claims 86 to 103, wherein all of said microparticles comprise a spectroscopically detectable marker.

105. The method of any of claims 86 to 103, wherein all of said microparticles comprise a fluorescence detectable marker.

106. The method of claim 105, wherein the fluorescence detectable marker is selected from the group consisting of dyes based on the structure of fluorescein, Oregon green, rhodamine, aminobenzoic acid, Alexa™ probes, BODIPY-dyes, cascade blue dye, coumarine, naphthalenes, dansyl, indoles, pyrenes pyridyloxazole, cascade yellow dye, Dapoxyl Dye, Fluorescamine, aromatic ortho dialdehydes, OPA and NDA, ATTO-Tag's, 7-Nitrobenz-2-Oxa-1,3-Diazole, and derivatives thereof.

107. The method of claim 105, wherein the fluorescence detectable marker is selected from the group consisting of fluorescent organic poly-cyclic com-

pounds, conjugated vinylic compounds, hetero-cyclic transition metal complexes, rare earth metal compounds, inorganic oxides and glasses.

108. The method of claim 105, wherein the fluorescence detectable marker is detectable by two photon fluorescence spectroscopy.

109. The method of claim 105, wherein the fluorescence detectable marker is detectable by one photon fluorescence spectroscopy.

110. The method of claim 105, wherein the fluorescence detectable marker is detectable by time-correlated photon fluorescence spectroscopy.

111. The method of any of claims 105 to 110, wherein the bead is optically transparent in the optical excitation ranges of said fluorescent marker and/or the emission wavelength ranges of said fluorescent marker.

112. The method of claim 111, wherein the bead comprises a polymer matrix selected from the group consisting of polyethers, polyvinyls, polyacrylates polyacylamides polyacrylamides, polystyrenes, polycarbonates, polyesters, polyamides, and combinations thereof.

113. The method of claim 111, wherein the bead comprises a material selected from the group consisting of silica, alumina, and titania.

114. The method of any of claims 111 and 112, wherein the bead comprises a polymer matrix selected from the group consisting of SPOCC, PEGA, HYDRA, POEPOP, PEG-polyacrylate copolymers, polyether-polyamine copolymers, cross-linked polyethylene di-amines, and combinations thereof.

115. The method of claim 111, wherein the beads comprise a marker, which is detectable by fast spectroscopic techniques other than fluorescence spectroscopy.

116. The method of claim 115, wherein the fast spectroscopic technique comprise Infrared spectroscopy, raman spectroscopy, visible light spectroscopy, UV spectroscopy, electron spin resonance, and nuclear magnetic resonance.

117. The method of claim 111, wherein said beads comprise a marker, which is detectable by fast detection techniques other than spectroscopy such as light scattering, reflection, diffraction or light rotation.

118. The method of any of claims 86 to 117, wherein the marker is detected by probing the marker with a range of frequencies differing by less than 10% based on the numerical highest frequency value.

119. The method of any of claims 86 to 118, wherein the marker is detected by probing the marker with one or more predetermined frequencies.

120. The method of any of claims 86 to 119, wherein the ratio R = a/b between a) the volume of the bead and b) the average volume of the microparticles is in the range of from 10000000:1 to 10:1.

121. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 1000000:1 to 30:1.

122. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 1000000:1 to 100:1.

123. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 1000000:1 to 200:1.

124. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 1000000:1 to 1000:1.

125. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 100000:1 to 1000:1.

126. The method of any of claims 86 to 119, wherein the ratio R = a/b is in the range of from 100000:1 to 2000:1.

127. The method of any of claims 86 to 119, wherein the at least one bead has an average volume of 0.000001 μL – 50 μL.

128. The method of any of claims 86 to 119, wherein the at least one bead has an average volume of 0.00001 μL – 5 μL.

129. The method of any of claims 86 to 119, wherein the at least one bead has an average volume of 0.001 μL – 1 μL.

130. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads are individually identifiable.

131. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^2 individually identifiable beads.

132. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^3 individually identifiable beads.

133. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^5 individually identifiable beads.

134. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^7 individually identifiable beads.

135. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^9 individually identifiable beads.

136. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^{11} individually identifiable beads.

137. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^{13} individually identifiable beads.

138. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^{15} individually identifiable beads.

139. The method of any of claims 86 to 129, wherein the plurality of different, spatially encoded, beads comprises at least 10^{17} individually identifiable beads.

140. The method of any of claims 86 to 139, wherein each bead comprises at least one site for functionalisation to which a ligand or a bioactive species can be attached.

141. The method of claim 140, wherein the site for functionalisation comprises a reactive group or a scaffold comprising two or more of such reactive groups.

142. The method of any of claims 49 to 141 comprising the further step of attaching a plurality of ligands or bioactive species to the bead, wherein different ligands or different bioactive species are attached to different beads, wherein more than about 95% of all of said different beads are individually identifiable.

143. The method of claim 142, wherein essentially all of said beads are individually identifiable.

144. The method of any of claims 49 to 142, wherein the optically detectable microparticle is selected from the group consisting of light reflecting mi-

croparticles, light absorbing microparticles, microparticles comprising one or more dyes, fluorescent microparticles, and auto-fluorescent microparticles.

145. The method of any of claims 49 to 144, wherein the optically detectable microparticles comprise fluorescence labelled polyethylene-grafted polystyrene microspheres.

146. The method of claim 145, wherein the diameter of the microspheres are from 10 to 30 micrometers, such as e.g. 10 micrometers, 20 micrometers, or 30 micrometers.

147. The method of claim 58, wherein the source of illumination is a laser, and wherein the optical power of the laser is in the range of from 1 mWatt to preferably less than about 500 mWatt, such as about 10 mWatt, for example about 50 mWatt, such as about 200 mWatt, for example about 100 mWatt.

148. The method of claim 147, wherein the wave length of the laser is in the range of from about 450 nm to preferably less than 700 nm, such as about 500 nm, for example about 600 nm.

149. The method of claim 66, wherein the exposure time of the image intensifiers and the CCD cameras is preferably in the range from about 0.1 millisecond to 100 milliseconds, such as in the range from 1 millisecond to 10 milliseconds, for example 5 milliseconds.

150. The method of any of claims 49 to 149, wherein the size distribution of the particles or beads is in the range of from 0.1 millimeter to preferably less than 2 millimeter, such as about 0.5 millimeter, for example about 1 millimeter, such as about 1.5 millimeter, and independently thereof, wherein the diameter of the microparaticles is preferably less than 40 micrometer, for example less than 30 micrometer, for example in the range of from 10 to 20 micrometers.

151. The method of any of claims 49 to 149, wherein the majority of the particles or beads, such as more than 75% of the particles or beads, for example

more than 90% of the particles or beads, are in the range of from 0.5 millimeter to 1 millimeter, and independently thereof, wherein the diameter of the spatially immobilised microparticles of said particles or beads is in the range of from 10 to 20 micrometers.